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CONDITIONS AFFECTING  
THE MILITARY UTILIZATION OF PEER RATINGS:  
THE NEWPORT STUDY

I. RELIABILITY



NAVY TECHNICAL REPORT 1-56  
ONR CONTRACT Nonr 760(06)  
January, 1956

E. P. Hollander  
Principal Investigator

Carnegie Institute of Technology  
Psychological Laboratories  
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### Acknowledgment

No research project conducted in the field may achieve any measure of success without the day-to-day cooperation of the personnel associated with the field activity itself. We were fortunate, indeed, to have such cooperation at Newport. To adequately catalogue the names of all those individuals to whom we are indebted to their support of this project would be no small feat.

It must suffice, therefore, for us to express our sincere sense of gratitude to the following individuals who exemplified the splendid tone of cooperation and good fellowship we found at the Officer Candidate School: Captain W. B. Perkins, USN, Commanding Officer of the Naval Schools Command and Officer-in-Charge of the OCS; Commander A. W. Venne, Jr., USN, Assistant Officer-in-Charge; Commander David Bryan, USN, Military Director; Lieutenant Commander John C. Powell, USN, Second Battalion Officer; and Chief Joseph F. Gleba, MAC, USN, of the Machine Records Office.

Finally, it would not do to conclude this expression of thanks without a nod to the student personnel of OCS Class 23 for their extraordinary fortitude in the face of a periodic onslaught of psychological devices.

### Summary

From research conducted with 23 trainee sections at the Naval OCS in Newport, data are presented relative to the reliability of peer nominations as it is affected by three variables: the period of time the group has spent together; the nature of the set given, i.e., "for research purposes" or "for administrative purposes"; and, the quality or characteristic to be evaluated by the nominator in making his nominations.

The following major findings are reported:

1. The reliability of forms administered very early in training--after the groups have been together for four to five days--is a reasonable approximation of the reliability obtained with the same forms and the same groups at later points in training.
2. The peer nomination scores obtained at the end of the third week of training correlate at a high level with those scores obtained on the same groups at a later level, i.e., sixth week.
3. There is no significant difference in the single-stage reliability or longitudinal reliability of comparable forms administered under the "research" as against the "administrative" set.
4. All forms--irrespective of the four different rated qualities involved--show a tendency to begin with substantial reliability and rise in subsequent administrations to only a slightly higher plateau.

While practical implications will be handled more comprehensively in later reports, it is concluded here that a peer nomination administered as early as the third week of training will yield substantially the same information as that which is now obtained at the sixth week, or even later. Furthermore, the data suggest that the "administrative" set leads to neither more nor less reliable scores than those secured through the presumably less threatening, or more lightly-taken, "research" set.

## I. Introduction

This is the first in a series of reports to deal with a large-scale study of peer ratings completed at the U. S. Naval School, Officer Candidate (OCS) in Newport, Rhode Island, during the summer and fall of 1955.

At the very outset, it is of significance to note that this study represented an expansion, rather than a replication, of the previous work in this sphere done at Newport by the American Institute for Research under Navy Contract Nonr 890(01). While the area of concern of the current project was somewhat more circumscribed than that of the previous project, we are appreciative of the basic data available to us from the work this group had already completed.

In simplest practical terms, the project was conceived to eventually provide more information regarding the application of peer ratings--specifically, "peer nominations"--as a supplemental screening device in the OCS. Although this issue will be touched upon here, the final project report will serve as the vehicle for a more comprehensive delineation of the relevant implications along this line.

The research objectives of this study, basically, were to determine the reliability and validity of peer ratings under various instructional sets and time exposures. Certain of the answers regarding ultimate validity must necessarily await the establishment of post-training criteria. At this time, however, it is both appropriate and feasible to report on the data available with regard to the reliability of the peer rating forms used.

## II. Background of the Problem

In practice, the so-called peer rating involves each group member's evaluation of his peers on some recognizable quality or set of characteristics which are manifested directly, or inferrable indirectly, from day-to-day, personal interactions. Such individual evaluations are then integrated into a composite score reflecting each person's standing in his group. The advantage of this technique appears to rest in its ability to yield unique supplementary data drawn from intimate contact among the personnel involved.

Peer rating procedures have already demonstrated a relatively high order of predictability against various performance criteria, with a substantial number of military groups (e.g., 4, 6, 7, 8, 11, 12, 13, 14, 15). It may be noted, too, that the greatest development of the peer ratings has taken place within the military services (3). Several questions remain to be answered, however, before optimum utilization of peer ratings may be effected.

## III. Statement of the Problem

For purposes of this interim report, three core problems may be specified for consideration. These involve, first, the length of time which the group must have spent together before peer ratings will approximate maximized validity and reliability; second, the presence of any differential effects on validity and reliability accruing from the use of peer ratings with a "research" set as against those with a "real" set; and, finally, the variations in validity and reliability which may be attributable to the nature of the quality on which the rater is instructed to rate the ratee.

As has been suggested, this report will confine itself to data bearing on the reliability aspect of these questions. The matter of validity will be appropriately considered in a subsequent report.

#### IV. Subjects and Setting

Through the joint cooperation of the Office of Naval Research, the Bureau of Naval Personnel, and the Naval OCS itself, the entire input of OCS Class 23 was made available for this study. The sample entered training in July of 1955 and consisted of 23 sections numbering about 30 men each; there is no reason to suppose that assignment to these sections was on anything other than a random basis. The total N available for study exceeded 700, at the beginning of this project.

The program at the OCS is of sixteen weeks duration, with an orientation week introduced before the actual onset of the training cycle. During this one-week period, student personnel are assigned to sections, receive books and clothing, take classification tests, receive orientation lectures, but do not attend formal classes, as such.

Except for a small minority drawn from the fleet--in this class numbering fewer than 5%--all of the students are graduates of four year college programs. The mean age of this class was 22 years with only a minimal dispersion above this figure.

Students at the OCS are selected according to rigorous mental and physical standards. All are volunteers, and must agree to remain on active duty as officers for three years following the successful conclusion of training.

#### V. Instruments

The previous work of Suci, Vallance, and Glickman (9) established several points which bore upon the selection of instruments for this study.



Their research indicates that ". . . ratings by peers based on either the behavior at OCS or projected, future behavior are equally reliable . . ." (9, p.11); in addition, they report that, "The technique which requires selection of the upper and lower segments appears to have as satisfactory reliability as any of the other tested techniques . . ." (9, p.11); finally, they note that the order of presentation which yields the lowest correlation between forms is "future officer" followed by "OCS behavior" (9, p.12).

Four basic sociometric forms of the peer nomination variety were utilized. Based upon the research cited above, a primary form was utilized with all sections which called for nominations on "success as a future Naval Officer" (FO). This form was seen to be of particular worth in its likely prediction of more distant, fleet performance criteria. In addition to this primary form, each section received one of three so-called secondary forms, i.e., "leadership qualities" (LQ), "interest in and enthusiasm for the Naval Service" (IE), and "probability of success in OCS" (OC). The selection of these forms rested upon a need to tap those characteristics which might relate to both in-training and post-training performance--i.e., interpersonal qualities, motivation, and ability having evident relevance to OCS performance.

Cutting across this pattern, approximately half the sections received a "research" set with the explicit point, appearing on their peer nomination forms, that "The results of these ratings are to be used for research purposes only and will not affect your Navy career." The other sections were given explicit instructions that "The results of these ratings may be used for administrative purposes." This split in treatment was designed to provide data on the differential reliability and validity resulting from administration under a "research" set as against an "administrative" set.

In all there were eight possible forms, i.e., four characteristics to be rated times two sets. In appendix A, form FO-RO is reproduced as an illustration of the format followed with all forms. Since this was varied only slightly to accommodate alternative instructions, the reader may view this as an example of the general instructions applied.

As will be noted, all of the forms required five "high" and five "low" nominations in order of preference. Each of the subjects was provided with a complete alphabetical roster of his sectionmates every time he was required to complete a form. The principal investigator was the sole administrator of the forms for all sections at all times.

#### VI. Study Design

The ultimate design of the study is reflected in Table 1. It will be seen that the 23 sections were divided into six blocks of four sections each, except for one block which, of necessity, was limited to three sections. Sections were assigned to blocks on a rotation basis from the five companies in the second battalion which comprised the class, i.e., How, Jig, King, Love, Mike. Such differences as might exist between companies were thus restricted in their conceivable ability to contaminate the study design.

Once having been assigned to a given block, the treatment of any given section was identical through training. Three major administrations of these forms was carried on during the training cycle: the first occurred during the so-called "orientation week"--referred to hereafter as the "0" week--after the subjects had been together in their respective sections for four to five days; at the end of the third week of training ("3" week); and, at the end of the sixth week of training ("6" week). The design appearing in Table I was replicated,

TABLE I  
Study Design\* Indicating  
Forms Used and Sections to Which Applied

Forms**	Section Allocation	
	Set	
	Research (RO)	Administrative (AU)
"Future Officer" (FO) "Interest & Enthusiasm" (IE)	H-1, J-1, L-1, M-1 A/	H-2, K-1, L-2, M-2 B/
"Future Officer" (FO) "Success in OCS" (OC)	H-3, H-4, J-4, K-4 C/	H-5, J-5, K-5 D/
"Future Officer" (FO) "Leadership Qualities" (LQ)	J-2, K-2, L-3, M-3 E/	J-3, K-3, L-4, M-4 F/

\*This design was applied at the end of the orientation week, third week, sixth week, and--except for the omission of the secondary forms--the thirteenth week.

\*\*Note that each section received two forms.

/Signifies group code designation.

therefore, a total of three times. At the end of the thirteenth week of training, another administration of forms was made, but this last time only the primary, "future officer," form was used. In all other respects, the design was identical for the latter administration.

#### VII. Scoring

Following the pattern utilized in several studies elsewhere (e.g., 4, 11), a direct weighting procedure was applied to derive peer nomination scores. The highest nominee was awarded a plus 5, the next highest, a plus 4, and so on through the five "highs"; similarly, the lowest nominee was assigned a minus 5, the next lowest, a minus 4, and so on. An algebraic sum was then obtained for each subject and divided by the N of the group minus 1, since no subject may nominate himself. This results in an average score ranging on a continuum from plus five to minus five. To remove the minus sign, a constant of 5 was added to this score; the resultant value was then multiplied by 10 in order to permit the use of a two digit score without the intervening decimal point. Where a subject had an average raw value of minus 5, and hence a score of 00, he was arbitrarily given a score of 01, after the constant had been added and the multiplication had taken place. At the other end of the range, the plus 5 subject was given a score of 99, rather than 100.

The distribution arising from this procedure has normal characteristics with a range from 1 to 99, a mean of 50, and a standard deviation approximating 10, for the total population of the study. While this score may be seen to have certain features of a standard score, it does not tend to obscure section differences so much as does the standard score. Furthermore, this score does not presume the homogeneity of characteristics from section to section which is assumed under a generalized standard score transformation.

### VIII. Determination of Reliability

Two major approaches may be followed in determining the reliability of peer nomination data. In the first place, one may focus attention on the internal consistency of the nominations made within a given group at some discrete point in time. In the second place, one may deal with their consistency over time, as reflected in repeat administrations.

Of the two approaches, the former is more typically applied. The latter approach has evident disadvantages in that time exposure is very likely to have an impact in altering the position of subjects on the status continuum. This raises the question of whether, indeed, a "good" peer nomination form ought to have high repeat reliability; in point of fact, one might wish to use peer nominations precisely for a study of temporal fluctuations in status, as well as the extent to which status is maintained. Thus, a low-level correlation between scores yielded by two administrations of the same peer nomination form is very often evidence of an unstable group pattern rather than of an inherent unreliability attributable to the form itself.

For our own purposes, we find both varieties of reliability of concern since we shall wish to know the internal consistency of scores obtained from various forms at various times, and the relationship over time of scores obtained from two administrations of the same form. Both considerations bear upon our problem.

In practice, the calculation of single-stage reliability, or internal consistency, of a peer nomination score is normally undertaken by an odd-even split of the raters within the group so as to afford two measures of status. The correlation between these measures is then treated by the Spearman-Brown formula to yield a corrected reliability coefficient.

## IX. Results and Discussion

Table II reports the corrected split-half reliability coefficients calculated at various points in the life cycle of relevant groups for the eight peer nomination forms utilized. The reduced N's are due to the fact that these coefficients were based upon a random selection of representative sections receiving the treatments involved. The identical sections are treated at each time period so as to control section variations which might obscure time effects.

It will be seen that the reliabilities in the first column, for all forms, approximate .90--even though the sections had been comprised only four or five days before. Omitting considerations of validity, it is striking to note the rapidity with which a group perception of individuals appears to have crystallized. This high reliability is of particular note when one considers that previous studies, based upon peer nomination scores drawn from later weeks of training, show r's which are not significantly greater (3). This is also reflected in our data here.

The yield, as regards higher reliabilities, is greater, but not significantly so, as one proceeds to later time periods. It would appear that the major increase occurs from the orientation week to the third week, after which the coefficients are stabilized. This is particularly discernible in the case of the FO forms which were carried through to a thirteenth week administration.

With respect to the reliability of comparable forms administered under a "research" (RO) as opposed to an "administrative" (AU) set, no differences of a significant magnitude may be noted at any time level. Their respective patterns are practically identical.

TABLE II  
Corrected Split-Half Reliabilities of  
Eight Peer Nomination Forms at  
Various Stages of Training

Week in Training

Forms	Orientation Week	Third Week	Sixth Week	Thirteenth Week
FO-RO	.94 96*	.97 92	.97 91	.97 91
FO-AU	.94 96	.97 96	.97 95	.95 91
IE-RO	.91 32	.96 29	.96 29	
IE-AU	.88 32	.89 32	.94 32	
LQ-RO	.93 32	.96 32	.96 31	
LQ-AU	.94 32	.97 32	.98 32	
OC-RO	.93 32	.98 31	.99 31	
OC-AU	.89 32	.97 32	.98 31	

\*The number below each coefficient indicates  
the N upon which it is based.

A contrast between the intercorrelation matrix for the "future officer" form administered at various stages under an RO set and the matrix for the same form under an AU set is to be seen in Table III. In most respects the matrices are quite comparable. Both indicate a sequential decrease in correlation between the orientation week scores and those scores obtained from later administrations. Both are notable for the high correlation, i.e., .90 and .94 respectively, between scores derived from the third and sixth week administrations. In general, the pattern for both matrices reflects a stability of measure from the third week administration onward. Except for a significance of difference beyond the 5% level--following a z transformation for the two coefficients just noted--none of the other pairings are significantly different. Thus, there is no broad disparity between the two matrices indicative of a differential effect on reliability attributable to the two sets under study.

Tables IV, V, and VI follow on the pattern established in Table III. In each case, two matrices are provided--one for the RO set and one for the AU set--indicating the intercorrelation of comparable secondary forms administered at three time levels; in each instance, these have been confined within a triangle. Data are also presented indicating the relationship of each secondary form to its primary (FO) counterpart at each time level.

Taken generally, the differences between comparable coefficients in the upper (RO) and lower (AU) matrices of these tables are not statistically significant for the three secondary forms. There is one exception to this, however; the orientation week correlation of FO-RO and LQ-RO is significantly higher than the parallel correlation of FO-AU and LQ-AU (Table VI).



TABLE III

Intercorrelation of Peer Nomination Scores for  
the "Future Officer" Form Administered Under Two Sets  
Independently at Four Stages of Training

	FO-RO "3" Week	FO-RO "6" Week	FO-RO "13" Week
FO-RO "0" Week	.74	.78*	.61
FO-RO "3" Week	---		.81
FO-RO "6" Week		---	.88
FO-RO "13" Week			---

N throughout equals 349

	FO-AU "3" Week	FO-AU "6" Week	FO-AU "13" Week
FO-AU "0" Week	.72	.81*	.65
FO-AU "3" Week	---		.83
FO-AU "6" Week		---	.91
FO-AU "13" Week			---

N throughout equals 320

\*These average r's were calculated from the triad  
by application of Fisher's z transformation.

TABLE IV

Intercorrelation of Peer Nomination Scores for  
the "Interest and Enthusiasm" Form  
Administered Under Two Sets Independently at  
Three Stages of Training With  
Relationship to "Future Officer" Scores at Each Stage

	IE-RO "0" Week	IE-RO "3" Week	IE-RO "6" Week
FO-RO "0" Week	.77		
IE-RO "0" Week	---		
FO-RO "3" Week			
IE-RO "3" Week		---	
FO-RO "6" Week			
IE-RO "6" Week			---

N throughout equals 119

	IE-AU "0" Week	IE-AU "3" Week	IE-AU "6" Week
FO-AU "0" Week	.86		
IE-AU "0" Week	---		
FO-AU "3" Week			
IE-AU "3" Week		---	
FO-AU "6" Week			
IE-AU "6" Week			---

N throughout equals 116

\*These average  $r$ 's were calculated from the triad  
by application of Fisher's  $z$  transformation.

TABLE V

Intercorrelation of Peer Nomination Scores for  
the "Success in OC3" Form  
Administered Under Two Sets Independently at  
Three Stages of Training With  
Relationship to "Future Officer" Scores at Each Stage

	OC-RO "0" Week	OC-RO "3" Week	OC-RO "6" Week
FO-RO "0" Week	.68		
OC-RO "0" Week	---		
FO-RO "3" Week			
OC-RO "3" Week		---	
FO-RO "6" Week			
OC-RO "6" Week			---

N throughout equals 112

	OC-AU "0" Week	OC-AU "3" Week	OC-AU "6" Week
FO-AU "0" Week	.82		
OC-AU "0" Week	---		
FO-AU "3" Week			
OC-AU "3" Week		---	
FO-AU "6" Week			
OC-AU "6" Week			---

N throughout equals 82

\*These average r's were calculated from the triad  
by application of Fisher's z transformation.

TABLE VI

Intercorrelation of Peer Nomination Scores for  
the "Leadership Qualities" Form  
Administered Under Two Sets Independently at  
Three Stages of Training With  
Relationship to "Future Officer" Scores at Each Stage

	LQ-RO "0" Week	LQ-RO "3" Week	LQ-RO "6" Week
FO-RO "0" Week	.91		
LQ-RO "0" Week	---	.82	.77
FO-RO "3" Week		.95	.87*
LQ-RO "3" Week		---	.94
FO-RO "6" Week			.96
LQ-RO "6" Week			---

N throughout equals 118

	LQ-AU "0" Week	LQ-AU "3" Week	LQ-AU "6" Week
FO-AU "0" Week	.75		
LQ-AU "0" Week	---	.85	.78
FO-AU "3" Week		.97	.83*
LQ-AU "3" Week		---	.95
FO-AU "6" Week			.97
LQ-AU "6" Week			---

N throughout equals 122

\*These average r's were calculated from the triad  
by application of Fisher's z transformation.

Considering now the triad of  $r$ 's representing the intercorrelation of each secondary form with itself at each time level, we find that the high relationship (about .90) between third and sixth week nomination scores is maintained for all forms, under both sets. Furthermore, it is possible to calculate an average intercorrelation for each triad so as to compare the stability of scores for the various forms and sets at various times. Using a  $z$  transformation of  $r$ 's, this has been done. These average  $r$ 's are presented in the center of each triad. A  $t$  test of these reveals no significant difference between sets for any of the forms, including FO, where only its first three administrations are considered.

Of all the secondary forms, LQ shows the highest average intercorrelation of the three scores. This is significantly greater beyond the 5% level for LQ-RO against OC-RO, and for LQ-AU against both OC-AU and IE-AU. The average intercorrelation for FO's first three administrations under both sets (Table III), is not significantly different from that found for any of the secondary forms. If, however, any one of the secondary forms is to be considered to yield the most consistent score over time, then this is the LQ form. Since the evidence is somewhat spotty, and since consistency may have its limitations, it would not do to suggest that the LQ is perforce the "best" form.

In Table VI it will be seen that the LQ scores have a substantially higher intercorrelation with FO scores from each time period than do the other two secondary scores (Cf. Tables IV and V); this difference for LQ against both IE and OC is significant beyond the 1% level for all three administrations of LQ under the RO set, and for the latter two administrations under an AU set. From the magnitude of the  $r$ 's involved, it would appear that the FO and LQ forms are being perceived as essentially similar.

## X. Conclusions

The data available from both varieties of reliability determination are essentially mutually supportive. The internal consistency of measure is high throughout the time sequence. Early nominations manifest a significant relationship to later nominations, by the same groups, with the same forms.

By the third week—and perhaps sooner, had we taken a sounding then--the nomination score is stabilized, at least insofar as its correlation with the sixth week score is concerned. In the case of our primary form (FO), where an additional administration is available, the third week score is significantly lower in relationship to the thirteenth week score than it is to the sixth week score. This does not necessarily vitiate the validity of the early reading, however.

Of particular interest is the question of the eventual worth of the very early, i.e., orientation week, ratings obtained here. While their relationship to later ratings is high, there is certainly not a one-to-one correspondence evident. That this should be so is understandable in view of the greater range of information available to the rater at later stages. Indeed, we may speculate that the essential virtue of the early rating is that it is based upon personal contact without the direct intrusion of academic performance considerations, which usually correlate appreciably with peer nominations.

In this regard, it is of interest to note the high temporal stability of the leadership rating, which tends to be founded in an "interpersonal quality" rather than an academically-loaded performance characteristic. Again, what this means in validity terms is an open question for the time. It is probable, however, that this has implications regarding the contribution of unique variance in the prediction of more ultimate criteria.

Added to this picture, too, is the relatively low level average inter-correlation of the OC scores, which are very likely subject to a greater degree of immediately observable fluctuations in classroom performance.

Since the FO score reveals an average intercorrelation with itself which is roughly intermediate for the range set by the secondary forms (LQ, OC, and IE), we may infer that it is sensitive to a broader range of impressions than the LQ score, at one extreme, or the OC score, at the other. This seems reasonable in view of the extrapolation required to a distant, and possibly diffuse, criterion.

The differences obtained between the administrative and research sets are minimal as regards any gain in reliability using one as opposed to the other. Among other things, it may be suggested that results already obtained from peer nomination studies, where a research set was involved, may be taken to have "real life" implications. A caution must be introduced, however, lest premature conclusions are drawn regarding the differential validity of forms administered under these two sets.

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APPENDIX A--FORM FO-RO

U. S. NAVAL SCHOOL, OFFICER CANDIDATE  
NEWPORT, RHODE ISLAND

You have been together with the men in this room since you entered OCS. From this contact, you will have formed certain impressions of them regarding their future success as Naval Officers.

Considering these impressions, and carefully weighing the qualities required in a successful Naval Officer, you are to select the five members of your section whom you consider to have the highest promise as Naval Officers, and the five members of your section whom you consider to have the lowest promise as Naval Officers.

THE RESULTS OF THESE RATINGS ARE TO BE USED FOR RESEARCH PURPOSES ONLY AND WILL NOT AFFECT YOUR NAVY CAREER.

Specifically, you are to perform these exact operations:

1. Consult the section roster which has been provided you and draw a line through your own name.

2. Study the remaining names on the roster and select the individual with the highest promise of success as a Naval Officer. Enter this name in the space labeled H-1 below and then draw a line through that name on the roster.

3. Study the roster again and then select the individual with the lowest promise. Enter this name in the space labeled L-1 below and then draw a line through that name on the roster.

4. Continue the study of this roster, alternately selecting individuals with the highest promise and the lowest promise, until you have entered ten names. Draw a line through each name on the roster as you write it in the proper place here.

HIGHEST PROMISE \_\_\_\_\_ H-1

\_\_\_\_\_ H-2

\_\_\_\_\_ H-3

\_\_\_\_\_ H-4

\_\_\_\_\_ H-5

\_\_\_\_\_ L-5

\_\_\_\_\_ L-4

\_\_\_\_\_ L-3

\_\_\_\_\_ L-2

LOWEST PROMISE \_\_\_\_\_ L-1